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ENGINEERING REPORT

FAA Contract No. DTFA03-02-C-00044
Phase I, CLIN 0001c - Target Area Report

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List of Acronyms

AD	Airworthiness Directive
BL	Butt Line (Aircraft Coordinate System)
BS	Body Station (Fuselage Aircraft Coordinate System)
CFR	Code of Federal Regulations
EO	Engineering Order (Delta internal document for modification instructions)
FASTER	FAA's Full-Scale Aircraft Structural Test Evaluation and Research facility
FS	Fuselage Station (Aircraft Coordinate System)
FWD	Forward
HAA	High Angle of Attack
ID	Identification (Used for marking and tracking teardown sections)
MED	Multiple Element Damage
MSD	Multiple Site Damage
SB	Service Bulletin
SS	Stabilizer Station (Aircraft Coordinate System)
SSI	Structurally Significant Item
SSID	Supplementary Structural Inspection Document
WFD	Widespread Fatigue Damage
WL	Water Line (Aircraft Coordinate System)
WS	Wing Station (Aircraft Coordinate System)

CHAPTER 1 - INTRODUCTION

Background

In performing structural evaluations and assessment for continued airworthiness of high-time operational aircraft, comprehensive destructive inspections have been and are routinely conducted in both the commercial and military sectors. Information and data developed from destructive evaluation and extended fatigue testing have been instrumental in ensuring structural integrity of aircraft, especially those nearing their design service goal (DSG). Destructive inspection activities are essential to evaluate airframe structure susceptible to widespread fatigue damage (WFD). Current advisory material to Section 25.571 of 14 Code of Federal Regulations (CFR), as revised by amendment 96, suggests post-test teardown inspection as a means of compliance but offers no further guidance.

While the expertise and knowledge base to conduct destructive (teardown) inspections are well established by the large commercial airframe original equipment manufacturer (OEM) and military sectors, comprehensive guidelines and data that are documented and available to the broader aviation community are lacking. In the civil arena, this information is proprietary and is disclosed only to the Federal Aviation Administration (FAA) who must rely on the OEM for interpretation of data.

The destructive testing and analysis of structure removed from retired aircraft can provide the FAA with first hand knowledge of destructive inspection procedures conducted in support of applications for continued airworthiness certification. Experience and knowledge gained from this destructive analysis will enable the FAA to issue essential rules, policy, and advisory circulars pertaining to the prevention of WFD. Extended fatigue and residual strength testing of sections of actual fleet aircraft will result in data which will enable calibration and validation of prediction methodologies and can serve as a test bed to evaluate the sensitivity and effectiveness of standard and emerging inspection technologies to detect small cracks.

Delta Air Lines has been contracted by the FAA to accomplish a destructive evaluation of a B727-232 nearing it's DSG (60,000 aircraft flight cycles). The aircraft that was chosen is registrations number N474DA (Line Number 1000) which is currently being stored in Victorville, California after completing 59,474 aircraft flight cycles.

Requirements

This report was written to accomplish DTFA03-02-C-00044, Part I - Section C, SCOPE OF WORK, Phase 1 0001c Task 3, *Select Target Areas For Destructive Analysis***.** In the base program, Delta Air Lines, in coordination with the FAA, will select four or more of the following fuselage structures susceptible to multiple site damage (MSD) and/or multiple element damage (MED) for examination:

a) Longitudinal Skin Joints, Frames, and Tear Straps of Pressure Vessel (MSD/MED)
b) Circumferential Joints and Stringers of Pressure Vessel (MSD/MED)
c) Lap joints with Milled, Chem-milled or Bonded Radius (MSD)
d) Fuselage Frames (MED)
e) Stringer to Frame Attachments of Fuselage (MED)
f) Shear Clip End Fasteners on Shear Tied Fuselage Frames (MSD/MED)

For the fuselage structures sections, the total area of all selected details shall not be less than 400 sq feet:

a) with not less than 90 linear feet of skin joints susceptible to MSD and
b) with not less than 10 recurrent structural elements susceptible to MED and
c) with not less than 250 individual details (e.g. rivet sites) susceptible to MSD or MED.

In addition, Delta Air Lines, in coordination with the FAA, will select six or more structures for use later in the optional program (if exercised by the FAA) that are susceptible to multiple site damage (MSD) and/or multiple element damage (MED) for examination:

a) Over Wing Fuselage Attachments (MED)
b) Latches and Hinges of Non-plug Doors (MSD/MED)
c) Aft Pressure Dome Outer Ring and Dome Web Splices (MSD/MED)
d) Skin Splice at Aft Pressure Bulkhead (MSD)
e) Abrupt Changes in Web or Skin Thickness - Pressurized or Unpressurized Structure (MSD/MED)
f) Window Surround Structure (MSD, MED)
g) Skin at Runout of Large Doubler (MSD)-Fuselage, Wing or Empennage
h) Wing or Empennage Chordwise Splices (MSD/MED)
i) Rib to Skin Attachments (MSD/MED)
j) Typical Wing and Empennage Construction (MSD/MED)

The target areas for destructive analysis in the base program shall include four fuselage panels suitable for extended fatigue cycling and residual strength tests using the Full-Scale Aircraft Structural Test Evaluation and Research (FASTER) facility located at the FAA William J. Hughes Technical Center, Atlantic City International Airport, NJ. A description of the facility and the requirements for the panels is attached to DTFA03-02-C-00044 as Attachment J-2 Appendix B.

Areas susceptible to MSD/MED are defined in RECOMMENDATIONS FOR REGULATORY ACTION TO PREVENT WIDESPREAD FATIGUE DAMAGE IN THE COMMERCIAL AIRPLANE FLEET, March 11, 1999 Revision A June 29, 1999. This report states that susceptible structure is defined as that which has the potential to develop MSD/MED. This structure has the characteristics of similar details operating at similar stress levels where structural capability could be significantly degraded by the presence of multiple cracks.

This report is considered to be deliverable for Phase 1, CLIN 0001c, Target Area Report.

Purpose

The purpose of this report is to present to the FAA a Target Area Report that will list the selected fuselage pressure vessel areas for destructive evaluation of aircraft N474DA including Boeing engineering drawings, engineering drawings of the sections removed for testing at the FASTER facility, location on aircraft and selection justification. In addition, this report will list the optional program areas with a brief description of there location and selection justification.

ID NUMBER	DESCRIPTION	LOCATION
F1	Forward Crown Pressure Vessel	BS 352 - 460, stringer 5L - 6R
F2	Aft Crown Pressure Vessel	BS 850 - 969, stringer 5L - 5R
F3	Forward Crown Pressure Vessel	BS 460 - 600, stringer 2R - 9R
F4	Forward Crown Pressure Vessel	BS 600 - 720A, stringer 2L - 9L
F5	Forward Crown Pressure Vessel	BS 720A - 760, stringer 2R - 9R
F6	Aft Crown Pressure Vessel	BS 969 - 1009, stringer 3L - 9L
F7	Window Belt Pressure Vessel	BS 720F - 890, stringer 9L - 16L
F8	Window Belt Pressure Vessel	BS 720F - 890, stringer 9R - 16R
F9	Forward Lower Pressure Vessel	BS 500 - 640, stringer 25L - 27L
F10	Forward Window Belt Pressure Vessel	BS 681 - 720F, stringer 9R - 16R
F11	Forward Window Belt Pressure Vessel	BS 481 - 590, stringer 9R - 10R
F12	Forward Window Belt Pressure Vessel	FWD galley door - BS 481, stringer 9R - 10R
F13	Forward Window Belt Pressure Vessel	BS 320 - 360, stringer 9R - 10R
F14	Forward Pressure Vessel & Floor Longeron	BS 303 - 370, stringer 17R
FT1	Forward Crown Pressure Vessel	BS 460 - 600, stringer 2R - 9L
FT2	Forward Crown Pressure Vessel	BS 600 - 720A, stringer 2L - 9R
FT3	Forward Crown Pressure Vessel	BS 720A - 760, stringer 2R - 9L
FT4	Aft Crown Pressure Vessel	BS 969 - 1009, stringer 3L - 9R
FT5	DELETED	
FT6	Aft Pressure Bulkhead and Skin Assy.	BS 1148 - 1193
FN1	Vertical Stabilizer Rib and Skin Assy.	rib number 2, left hand half
FN2	Vertical Stabilizer Rib and Skin Assy.	rib number 2, right hand half
H1	Horizontal Stabilizer Ribs and Skin Assy.	closure rib - SS 32.08 inspar rib, left hand side
H2	Horizontal Stabilizer Ribs and Skin Assy.	closure rib - SS 32.08 inspar rib, right hand side
W1	DELETED	
W2	Upper Center Wing Splice and Fuselage Attachment	BBL 70.50, upper half of right hand wing - stringer 16R
W3	DELETED	
W4	Lower Center Wing Splice	BBL 70.50, lower half of right hand wing
W5	Center Wing Front Spar Upper Chord and Web	upper edge of lower chord - entire upper half of wing
W6	Outer Wing Box	WS 330.5 - 436.5, left hand wing
W7	Outer Wing Box	WS 330.5 - 436.5, right hand wing

Table 1. B727 Target Areas

CHAPTER 2 - RESULTS AND CONCLUSION

The Target areas contain the following five fuselage structures susceptible to MSD and/or MED.

a) Longitudinal Skin Joints, Frames, and Tear Straps of Pressure Vessel (MSD/MED)

b) Circumferential Joints and Stringers of Pressure Vessel (MSD/MED)

d) Fuselage Frames (MED)

e) Stringer to Frame Attachments of Fuselage (MED)

f) Shear Clip End Fasteners on Shear Tied Fuselage Frames (MSD/MED)

The target areas that make up the primary fuselage structures contain approximately 156 linear feet of skin joints susceptible to MSD cracking, 76 recurrent structural elements susceptible to MED, 1455 individual details susceptible to MSD and 5288 individual details susceptible to MED. As these items far exceed the requirements of the contract, the details examined will be narrowed based on service history, likely hood of cracking (stress levels) and input from the FAA.

The Target areas contain the following eight optional structures susceptible to MSD and/or MED.

a) Over Wing Fuselage Attachments (MED)

d) Skin Splice at Aft Pressure Bulkhead (MSD)

e) Abrupt Changes in Web or Skin Thickness — Pressurized or Unpressurized Structure (MSD/MED)

f) Window Surround Structure (MSD, MED)

h) Wing or Empennage Chordwise Splices (MSD/MED)

i) Rib to Skin Attachments (MSD/MED)

j) Typical Wing and Empennage Construction (MSD/MED)

There were only four fuselage panels that were suitable for extended fatigue cycling and residual strength tests using the FASTER facility. As recommended by the FAA, a mix of small and large cracked panels were preliminarily chosen for testing at the FASTER facility. As most of the large cracks were found on the right hand side stringer 4 lap joints, two panels were chosen with stringer 4 right hand lap joints in them and two were chosen with left hand lap joints.

CHAPTER 3 - DISCUSSION OF PRIMARY FUSELAGE STRUCTURES

Fuselage FT1/F3

In order to determine the best panels for testing at the FASTER facility, the fuselage examination panel F3 and the fuselage test panel FT1 were removed in one section. This will allow the entire panel to be inspected at Delta Air Line's Atlanta facility in order to determine the best portion of the panel for testing at the FAA FASTER facility. The preliminary test and examination panels are shown in Figures 1 and 3. This section is located in the forward fuselage crown area of the pressure vessel. The panel extends between circumferential cuts at BS 460 and BS 600 and longitudinal cuts at stringers 9L and 9R. The sections to be modified and tested at the FASTER facility are preliminarily located between stringers 2R and 9L with the stringer 4L lap joint located as close as possible to the center.

This section was cut from structure that was defined in the following fuselage panel installation drawings:

- Boeing DWG 65-54570-1 Skin panel installation, STA 360 – 481, S-4L – S-10L
- Boeing DWG 65-54570-2 Skin panel installation, STA 360 – 481, S-4R – S-10R
- Boeing DWG 65-54574-59 Skin panel installation, STA 481 – 740, S-4L – S-10L
- Boeing DWG 65-54574-60 Skin panel installation, STA 481 – 740, S-4R – S-10R
- Boeing DWG 65-54574-63 Skin panel installation, STA 481 – 740, S-4L – S-4R
- Boeing DWG 65-18217-36 Skin panel installation, STA 360 – 481, S-4L – S-4R

This section was chosen for examination and testing for the following reasons.

1. It contains the following fuselage structures outlined in DTAFA03-02-C-00044, Part I - Section C, SCOPE OF WORK.
    a) Longitudinal Skin Joints, Frames, and Tear Straps of Pressure Vessel (MSD/MED)
    b) Circumferential Joints and Stringers of Pressure Vessel (MSD/MED)
    d) Fuselage Frames (MED)
    e) Stringer to Frame Attachments of Fuselage (MED)
2. It contains sections of stringer 4 left and right hand lap joints which are indicated as susceptible to cracking per AD 99-04-22, AD 2002-07-09 and Boeing SB 727-53-0222 (Figure 9).

3. It contains sections of stringer 4 left and right hand lap joints which are indicated as requiring

inspection per SSI Document D6-48040-1 (SSI F-43, Figure 8).

4. It is located in an area that has high circumferential fatigue stresses making the lap joints and skin stringer fastener holes susceptible to MSD cracking as indicated in Figure 2.
5. It contains 22 linear feet of skin joints susceptible to MSD cracking, 15 recurrent structural elements susceptible to MED , approximately 210 individual details susceptible to MSD and approximately 300 individual details susceptible to MED
6. It is located predominantly in the constant section of the aircraft which is required for FASTER facility testing.
7. The left hand side has been preliminarily chosen for testing because the stringer 4 right hand side lap joint had a significant amount of cracks found during nondestructive testing which would end up being cut up during the modification of the panel for testing at the FASTER facility. Choosing the left side for FASTER testing allows the cracks on the right side to be destructively characterized as found in service.

Fuselage FT2/F4

In order to determine the best panels for testing at the FASTER facility, the fuselage examination panel F4 and the fuselage test panel FT2 were removed in one section. This will allow the entire panel to be inspected at Delta Air Line's Atlanta facility in order to determine the best portion of the panel for testing at the FAA FASTER facility. The preliminary test and examination panels are shown in Figures 1 and 4. This section is located in the forward fuselage crown area of the pressure vessel. The panel extends between circumferential cuts at BS 600 and BS 720A and longitudinal cuts at stringers 9L and 9R. The sections to be modified and tested at the FASTER facility are preliminarily located between stringers 2L and 9R with the stringer 4R lap joint located as close as possible to the center.

This section was cut from structure that was defined in the following fuselage panel installation drawings:

- Boeing DWG 65-54574-59 Skin panel installation, STA 481 – 740, S-4L – S-10L
- Boeing DWG 65-54574-60 Skin panel installation, STA 481 – 740, S-4R – S-10R
- Boeing DWG 65-54574-63 Skin panel installation, STA 481 – 740, S-4L – S-4R

This section was chosen for examination and testing for the following reasons.

1. It contains the following fuselage structures outlined in DTAFA03-02-C-00044, Part I - Section C, SCOPE OF WORK.
    a) Longitudinal Skin Joints, Frames, and Tear Straps of Pressure Vessel (MSD/MED)
    b) Circumferential Joints and Stringers of Pressure Vessel (MSD/MED)
    d) Fuselage Frames (MED)
    e) Stringer to Frame Attachments of Fuselage (MED)
2. It contains sections of stringer 4 left and right hand lap joints which are indicated as susceptible to cracking per AD 99-04-22, AD 2002-07-09 and Boeing SB 727-53-0222 (Figure 9).
2. It contains sections of stringer 4 left and right hand lap joints which are indicated as requiring inspection per SSI Document D6-48040-1 (SSI F-43, Figure 8).
2. It is located in an area that has high circumferential fatigue stresses making the lap joints and skin stringer fastener holes susceptible to MSD cracking as indicated in Figure 2.
2. It contains 22 linear feet of skin joints susceptible to MSD cracking, 15 recurrent structural elements susceptible to MED , approximately 210 individual details susceptible to MSD and approximately 300 individual details susceptible to MED
2. It is located completely in the constant section of the aircraft which is required for FASTER facility testing.
2. The right hand side has been preliminarily chosen for testing to get a good mix of large and small cracks for testing. This is because there are other adjacent panels that had a significant amounts of cracks found during nondestructive testing which would have ended up being cut up during the modification of the panel for testing at the FASTER facility. Most of the large cracks found during non-destructive testing were on the right hand side of the aircraft.

Fuselage FT3/F5

In order to determine the best panels for testing at the FASTER facility, the fuselage examination panel F5 and the fuselage test panel FT3 were removed in one section. This will allow the entire panel to be inspected at Delta Air Line's Atlanta facility in order to determine the best portion of the panel for testing at the FAA FASTER facility. The preliminary test and examination panels are shown in Figures 1 and 5. This section is located just forward of the wing front spar in the crown area of the pressure vessel. The panel extends between circumferential cuts at BS 720A and BS 760 and longitudinal cuts at stringers 9L and 9R. The sections to be modified and tested at the FASTER facility are preliminarily located between stringers 2R and 9L with the stringer 4L lap joint located as close as possible to the center.

This section was cut from structure that was defined in the following fuselage panel installation drawings:

- Boeing DWG 65-54574-59 Skin panel installation, STA 481 – 740, S-4L – S-10L
- Boeing DWG 65-54574-60 Skin panel installation, STA 481 – 740, S-4R – S-10R
- Boeing DWG 65-54574-63 Skin panel installation, STA 481 – 740, S-4L – S-4R
- Boeing DWG 65-18380-113 Skin panel installation, STA 740 – 870, S-4L – S-10L
- Boeing DWG 65-18380-114 Skin panel installation, STA 740 – 870, S-4R – S-10R
- Boeing DWG 65-18380-115 Skin panel installation, STA 740 – 870, S-4L – S-4R

This section was chosen for examination and testing for the following reasons.

1. It contains the following fuselage structures outlined in DTAFA03-02-C-00044, Part I - Section C, SCOPE OF WORK.
    a) Longitudinal Skin Joints, Frames, and Tear Straps of Pressure Vessel (MSD/MED)
    b) Circumferential Joints and Stringers of Pressure Vessel (MSD/MED)
    d) Fuselage Frames (MED)
    e) Stringer to Frame Attachments of Fuselage (MED)
2. It contains sections of stringer 4 left and right hand lap joints which are indicated as susceptible to cracking per AD 2002-07-09 and Boeing SB 727-53-0222 (Figure 9).

3. It is located in an area that has high fatigue shear loads combined with moderate circumferential

fatigue stresses making the lap joints and skin stringer fastener holes susceptible to MSD cracking and the frames where they attach to the stringers susceptible to MED cracking as indicated in Figure 2.

4. It is located in an area that has high longitudinal fatigue stresses making it susceptible to MSD cracking in the circumferential butt joints and MED cracking in the stringers where they attach to the frames as indicated in Figure 2.
5. It contains 22 linear feet of skin joints susceptible to MSD cracking, 15 recurrent structural elements susceptible to MED , approximately 210 individual details susceptible to MSD and approximately 300 individual details susceptible to MED
6. It is located completely in the constant section of the aircraft which is required for FASTER facility testing.
7. The left hand side has been preliminarily chosen for testing to get a good mix of large and small cracks for testing. Most of the large cracks found during non-destructive testing were on the right hand side of the aircraft. Choosing the left side for FASTER testing allows the cracks on the right side to be destructively characterized as found in service.

Fuselage FT4/F6

In order to determine the best panels for testing at the FASTER facility, the fuselage examination panel F6 and the fuselage test panel FT4 were removed in one section. This will allow the entire panel to be inspected at Delta Air Line's Atlanta facility in order to determine the best portion of the panel for testing at the FAA FASTER facility. The preliminary test and examination panels are shown in Figures 1 and 6. This section is located in the aft fuselage section in the crown area of the pressure vessel. The panel extends between circumferential cuts at BS 969 and BS 1009 and longitudinal cuts at stringers 9L and 9R. The sections to be modified and tested at the FASTER facility are preliminarily located between stringers 3L and 9R with the stringer 4R lap joint located as close as possible to the center and the right edge outside of the aft service door surround structure.

This section was cut from structure that was defined in the following fuselage panel installation drawings:

- Boeing DWG 65-54578-51 Skin panel installation, STA 870 – 1009, S-4L – S-10L
- Boeing DWG 65-54578-52 Skin panel installation, STA 870 – 1009, S-4R – S-10R
- Boeing DWG 65-54578-58 Skin panel installation, STA 870 – 1009, S-4L – S-4R
- Boeing DWG 65-54582-43 Skin panel installation, STA 870 – 1009, S-4L – S-10L
- Boeing DWG 65-54582-44 Skin panel installation, STA 870 – 1009, S-4R – S-10R
- Boeing DWG 65-54582-1 Skin panel installation, STA 870 – 1009, S-4L – S-4R

This section was chosen for examination and testing for the following reasons.

1. It contains the following fuselage structures outlined in DTAFA03-02-C-00044, Part I - Section C, SCOPE OF WORK.
    a) Longitudinal Skin Joints, Frames, and Tear Straps of Pressure Vessel (MSD/MED)
    b) Circumferential Joints and Stringers of Pressure Vessel (MSD/MED)
    d) Fuselage Frames (MED)
    e) Stringer to Frame Attachments of Fuselage (MED)
    f) Shear Clip End Fasteners on Shear Tied Fuselage Frames (MSD/MED)
2. It contains sections of stringer 4 left and right hand lap joints which are indicated as requiring inspection per SSI Document D6-48040-1 (SSI F-43, Figure 8).
2. It contains sections of stringer 4 left and right hand lap joints which are indicated as susceptible to cracking per AD 2002-07-09 and Boeing SB 727-53-0222 (Figure 9).
2. It is located in an area that has moderate fatigue shear loads combined with high circumferential fatigue stresses making the lap joints and stringer fastener holes susceptible to MSD and the frames where they attach to the stringers susceptible to MED cracking as indicated in Figure 2.
2. It contains 22 linear feet of skin joints susceptible to MSD cracking, 15 recurrent structural elements susceptible to MED , approximately 210 individual details susceptible to MSD and approximately 300 individual details susceptible to MED
2. It is located completely in the constant section of the aircraft which is required for FASTER facility testing.
2. The right hand side has been preliminarily chosen for testing because there is ground damage to the stringers on the left hand side of the aircraft.

Fuselage F1

The F1 examination panel is shown in Figure 1. This section is located in the forward fuselage crown area of the pressure vessel. The panel extends between circumferential cuts at BS 352 and BS 460 and longitudinal cuts at stringers 5L and 6R.

This section was cut from structure that was defined in the following fuselage panel installation drawings:

- Boeing DWG 65-18420-406 Skin panel installation, STA 259.5– 360
- Boeing DWG 65-54570-1 Skin panel installation, STA 360 – 481, S-4L – S-10L
- Boeing DWG 65-54570-2 Skin panel installation, STA 360 – 481, S-4R – S-10R
- Boeing DWG 65-18217-36 Skin panel installation, STA 360 – 481, S-4L – S-4R

This section was chosen for examination and testing for the following reasons.

1. It contains the following fuselage structures outlined in DTAFA03-02-C-00044, Part I - Section C, SCOPE OF WORK.
    a) Longitudinal Skin Joints, Frames, and Tear Straps of Pressure Vessel (MSD/MED)
    b) Circumferential Joints and Stringers of Pressure Vessel (MSD/MED)
    d) Fuselage Frames (MED)
    e) Stringer to Frame Attachments of Fuselage (MED)
2. It contains sections of stringer 4 left and right hand lap joints which are indicated as susceptible to cracking per AD 99-04-22, AD 2002-07-09 and Boeing SB 727-53-0222 (Figure 9).
2. It contains sections of stringer 4 left and right hand lap joints which are indicated as requiring inspection per SSI Document D6-48040-1 (SSI F-43, Figure 8).
2. It is located in an area that has high circumferential fatigue stresses making the lap joints and skin stringer fastener holes susceptible to MSD cracking as indicated in Figure 2.
2. It contains 18 linear feet of skin joints susceptible to MSD cracking, 8 recurrent structural elements susceptible to MED , approximately 150 individual details susceptible to MSD and approximately 160 individual details susceptible to MED

Fuselage F2

The F2 examination panel is shown in Figure 1. This section is located just aft of the aft spar of the wing in the crown area of the pressure vessel. The panel extends between circumferential cuts at BS 850 and BS 969 and longitudinal cuts at stringers 5L and 5R. Because of the panels size, it was cut in half for shipping.

This section was cut from structure that was defined in the following fuselage panel installation drawings:

- Boeing DWG 65-18380-113 Skin panel installation, STA 740 – 870, S-4L – S-10L
- Boeing DWG 65-18380-114 Skin panel installation, STA 740 – 870, S-4R – S-10R
- Boeing DWG 65-18380-115 Skin panel installation, STA 740 – 870, S-4L – S-4R
- Boeing DWG 65-54578-51 Skin panel installation, STA 870 – 1009, S-4L – S-10L
- Boeing DWG 65-54578-52 Skin panel installation, STA 870 – 1009, S-4R – S-10R
- Boeing DWG 65-54578-58 Skin panel installation, STA 870 – 1009, S-4L – S-4R

This section was chosen for examination and testing for the following reasons.

1. It contains the following fuselage structures outlined in DTAFA03-02-C-00044, Part I - Section C, SCOPE OF WORK.
    a) Longitudinal Skin Joints, Frames, and Tear Straps of Pressure Vessel (MSD/MED)
    b) Circumferential Joints and Stringers of Pressure Vessel (MSD/MED)
    d) Fuselage Frames (MED)
    e) Stringer to Frame Attachments of Fuselage (MED)
2. It contains sections of stringer 4 left and right hand lap joints which are indicated as susceptible to cracking per AD 2002-07-09 and Boeing SB 727-53-0222 (Figure 9).
2. It contains sections of stringer 4 left and right hand lap joints which are indicated as requiring inspection per SSI Document D6-48040-1 (SSI F-43, Figure 8).
2. It is located in an area that has high fatigue shear loads combined with moderate circumferential fatigue stresses making the lap joints and stringer fastener holes susceptible to MSD and the frames where they attach to the stringers susceptible to MED cracking as indicated in Figure 2.
2. It is located in an area that has high longitudinal fatigue stresses making it susceptible to MSD cracking in the circumferential butt joints and MED cracking in the stringers where they attach to the frames as indicated in Figure 2.

3. It contains 39 linear feet of skin joints susceptible to MSD cracking, 7 recurrent structural elements susceptible to MED , approximately 360 individual details susceptible to MSD and approximately 308 individual details susceptible to MED

Fuselage F9

The F9 examination panel is shown in Figure 1. This section is located in the forward lower fuselage area of the pressure vessel. The panel extends between circumferential cuts at BS 500 and BS 640 and longitudinal cuts at stringers 25L and 27L.

This section was cut from structure that was defined in the following fuselage panel installation drawings:

- Boeing DWG 65-54571-1 Skin panel installation, STA 441 – 681, S-14L – S-26L
- Boeing DWG 65-54573-1 Skin panel installation, STA 441 – 681, S-26L – S-26R

This section was chosen for examination and testing for the following reasons.

1. It contains the following fuselage structures outlined in DTAFA03-02-C-00044, Part I - Section C, SCOPE OF WORK.
    a) Longitudinal Skin Joints, and Frames of Pressure Vessel (MSD/MED)
    d) Fuselage Frames (MED)
    e) Stringer to Frame Attachments of Fuselage (MED)
    f) Shear Clip End Fasteners on Shear Tied Fuselage Frames (MSD/MED)
2. It contains a section of the stringer 26 left hand lap joint which is indicated as susceptible to cracking per AD 99-04-22, AD 2002-07-09 and Boeing SB 727-53-0222 (Figure 9).
2. It contains sections of the stringer 26 left hand lap joint which is indicated as requiring inspection per SSI Document D6-48040-1 (SSI F-43, Figure 8).
2. It is located in an area that has high circumferential fatigue stresses making the lap joints and skin stringer fastener holes susceptible to MSD cracking.
2. It contains 11 linear feet of skin joints susceptible to MSD cracking, 1 recurrent structural element susceptible to MED , approximately 105 individual details susceptible to MSD and approximately 20 individual details susceptible to MED

CHAPTER 4 - OPTIONAL STRUCTURES

Fuselage Test Section FT6

The FT6 optional section is shown in Figure 1. This section is located at BS 1183 at the aft end of the pressure vessel. The section extends between circumferential cuts at BS 1148 and BS 1193 and contain the entire BS 1183 bulkhead and attached skin assembly.

This section was chosen as an optional item for the following reasons.

1. It contains the following structure as outlined in DTAFA03-02-C-00044, Part I - Section C, SCOPE OF WORK.

    d) Skin Splice at Aft Pressure Bulkhead (MSD)

2. The bulkhead web and stiffeners are susceptible to cracking in many areas and there are twelve Boeing service bulletins for these areas.

2. It contains areas that are indicated as requiring inspection per SSI Document D6-48040-1 (SSI F-41D & E - BS 1183 Circumferential Splice).

Fuselage F7 and F8

The F7 and F8 option panels are shown in Figure 1. This section is located in the over wing window belt area of the pressure vessel. The panels extend between circumferential cuts at BS 720F and BS 890 and longitudinal cuts at stringers 9 and 16.

This section was chosen as an optional item for the following reasons.

1. It contains the following structure as outlined in DTAFA03-02-C-00044, Part I - Section C, SCOPE OF WORK.

    f) Window Surround Structure (MSD, MED)

2. It is located in an area that has high shear loads.

2. It contains areas that are indicated as requiring inspection per SSI Document D6-48040-1 (SSI F-9 - Emergency Exit Hatch Cutout).

Fuselage F10

The F10 optional panel is shown in Figure 1. This section is located in the forward window belt area of the pressure vessel. The panel extends between circumferential cuts at BS 680 and BS 720F and longitudinal cuts at stringers 9R and 16R.

This section was chosen as an optional item for the following reasons.

1. It contains the following structure as outlined in DTAFA03-02-C-00044, Part I - Section C, SCOPE OF WORK.

    f) Window Surround Structure (MSD, MED)

2. It contains a section of the stringer 14 lap joint that was modified with protruding head rivets.

Fuselage F11

The F11 optional panel is shown in Figure 1. This section is located in the forward window belt area of the pressure vessel. The panel extends between circumferential cuts at BS 481 and BS 590 and longitudinal cuts above and below stringer 10R.

At the request of the FAA, this section was chosen as an optional item because It contains a section of adjacent delaminated tear straps at a lap joint (MED).

Fuselage F12

The F12 optional panel is shown in Figure 1. This section is located in the forward window belt area of the pressure vessel. The panel extends between the forward galley door and a circumferential cut at BS 481 and longitudinal cuts above and below stringer 10R.

At the request of the FAA, this section was chosen as an optional item because It contains a section of adjacent delaminated tear straps at a lap joint (MED).

Fuselage F13

The F13 optional panel is shown in Figure 1. This section is located in the nose section window belt area of the pressure vessel. The panel extends between circumferential cuts at BS 320 and BS 360 and longitudinal cuts above and below stringer 10R.

At the request of the FAA, this section was chosen as an optional item because it contains a section of adjacent delaminated tear straps at a lap joint (MED).

Fuselage F14

The F14 optional panel is shown in Figure 1. This section is located in the nose section of the pressure vessel. The panel extends between circumferential cuts at BS 303 and BS 370 and longitudinal cuts above and below stringer 17R and contains a small section of the floor longeron.

At the request of the FAA and recommendation of Boeing, this section was chosen as an optional item because it contains an area where the skin to floor longeron attachments are susceptible to MSD cracking.

Vertical Stabilizer FN1 and FN 2

The FN1 and FN2 optional panels are shown in Figure 1. This section is located in the vertical stabilizer at the number 2 rib. The panels extend around the number 2 rib located at fin station

-6.377 and contain the entire fin section from the forward spar to the aft spar.

This section was chosen as an optional item for the following reasons.

1. It contains the following structures as outlined in DTAFA03-02-C-00044, Part I - Section C, SCOPE OF WORK.
    i) Rib to Skin Attachments (MSD/MED)
    j) Typical Wing and Empennage Construction (MSD/MED)

2. It contains rib to stringer attachments that are susceptible to MED cracking as indicated in Boeing service Bulletin 727-55-0075.
3. The fin stingers at the No. 2 rib have a service history of being susceptible to MED cracking.
4. It contains areas that are indicated as requiring inspection per SSI Document D6-48040-1 (SSIs E-8 - Fin Skin and Stringers, Typical & E-10 - Fin Ribs, Typical).

Horizontal Stabilizer H1 and H2

The H1 and H2 optional panels are shown in Figure 1. This section is located in the horizontal stabilizer. The panels extend from the closure rib to stabilizer station 32.08 inspar rib and contain the entire stabilizer section from the forward spar to the aft spar.

This section was chosen as an optional item for the following reasons.

1. It contains the following structures as outlined in DTAFA03-02-C-00044, Part I - Section C, SCOPE OF WORK.
    i) Rib to Skin Attachments (MSD/MED)
    j) Typical Wing and Empennage Construction (MSD/MED)
2. This section contains full depth stabilizer stringer/longitudinal intermediate spars that all end at SS 32.08 inspar rib. There are no other stringers in the outboard section of the stabilizer making this area susceptible to MSD cracking at the run out.
2. It contains areas that are indicated as requiring inspection per SSI Document D6-48040-1 (SSIs E-35 - Horizontal Stabilizer Closure Rib & E-36 - Horizontal Stabilizer Inspar Rib Upper Chord).

Wing W2

The W2 optional panel is shown in Figure 1. This section is located at the right hand upper wing root at BBL 70.5. The panel extends from stringer 16R of the fuselage pressure vessel to half way down the center wing rib. This section contains both the upper center wing skin splice and the wing to fuselage attach points.

This section was chosen as an optional item for the following reason.

1. It contains the following structures as outlined in DTAFA03-02-C-00044, Part I - Section C, SCOPE OF WORK.

    a) Over Wing Fuselage Attachments (MED)

    h) Wing or Empennage Chordwise Splices (MSD/MED)

2. It contains sections of frames which are indicated as susceptible to MED cracking per AD 94-02-04 and Boeing service Bulletin 727-53-0197.

3. It contains areas that are indicated as requiring inspection per SSI Document D6-48040-1 (SSIs F-55 - Skin at Wing Rib Upper Chord, W-11 - Upper Splice BBL 70.5 & W-12 - Wing to Body Joint).

Wing W4

The W4 optional panel is shown in Figure 1. This section is located at the right hand lower wing root at BBL 70.5. The panel extends from half way down the center wing rib to the bottom of the wing. This section contains the lower center wing skin splice.

This section was chosen as an optional item for the following reason.

1. It contains the following structure as outlined in DTAFA03-02-C-00044, Part I - Section C, SCOPE OF WORK.

    h) Wing or Empennage Chordwise Splices (MSD/MED)

    j) Typical Wing and Empennage Construction (MSD/MED)

2. It contains areas that are indicated as requiring inspection per SSI Document D6-48040-1 (SSI W-10 - Lower Splice BBL 70.5).

Wing W5

The W5 optional panel is shown in Figure 1. This section is located at the center wing front spar. The panel extends from LBL 60.5 to RBL 60.5. This section contains the front spar web just above the lower chord, the front spar upper chord and a section of the wing skin assembly attached to it.

This section was chosen as an optional item for the following reasons.

1. It contains the following structure as outlined in DTAFA03-02-C-00044, Part I - Section C, SCOPE OF WORK.

    e) Abrupt Changes in Web or Skin Thickness — Pressurized or Unpressurized Structure (MSD/MED)

2. It contains chemical milled steps in the spar web that are susceptible to MSD cracking as indicated in Boeing SB 727-57-0177.

3. At the request of the FAA and recommendation of Boeing, this section was chosen as an optional item because of it's susceptible to cracks in the spar web.

4. It contains areas that are indicated as requiring inspection per SSI Document D6-48040-1 (SSI W-4 - Center Section Front Spar Upper Chord, Web and Skin).

Wing W6 and W7

The W6 and W7 optional panels are shown in Figure 1. These panels are located in the left and right hand outer wing sections. The panel extends from wing station 330.5 to 436.5 and contains the entire wing box from the front spar to the rear spar.

This section was chosen as an optional item for the following reasons.

1. It contains the following structure as outlined in DTAFA03-02-C-00044, Part I - Section C, SCOPE OF WORK.

    j) Typical Wing and Empennage Construction (MSD/MED)

2. It is located in an area that has high longitudinal fatigue stresses making it susceptible to MED cracking in the stringers where they attach to the ribs as indicated in Figure 7.

3. It contains areas that are indicated as requiring inspection per SSI Document D6-48040-1 (SSIs W-18 - Rear Spar Upper Chord Web and Skin, W-19 - Rear Spar Lower Chord Web and Skin, W-20 - Front Spar Lower Chord Web and Skin, W-21 - Front Spar Upper Chord Web and Skin, W-27 - Lower Surface Access Cutouts, Stringers and Skin, W-29 - Lower Surface Splice Stringers and Skin, W-30 - Upper Surface Splice Stringer and Skin & W-33 - Rib Chords, Shear Ties and Rib-to-Stringer joints).

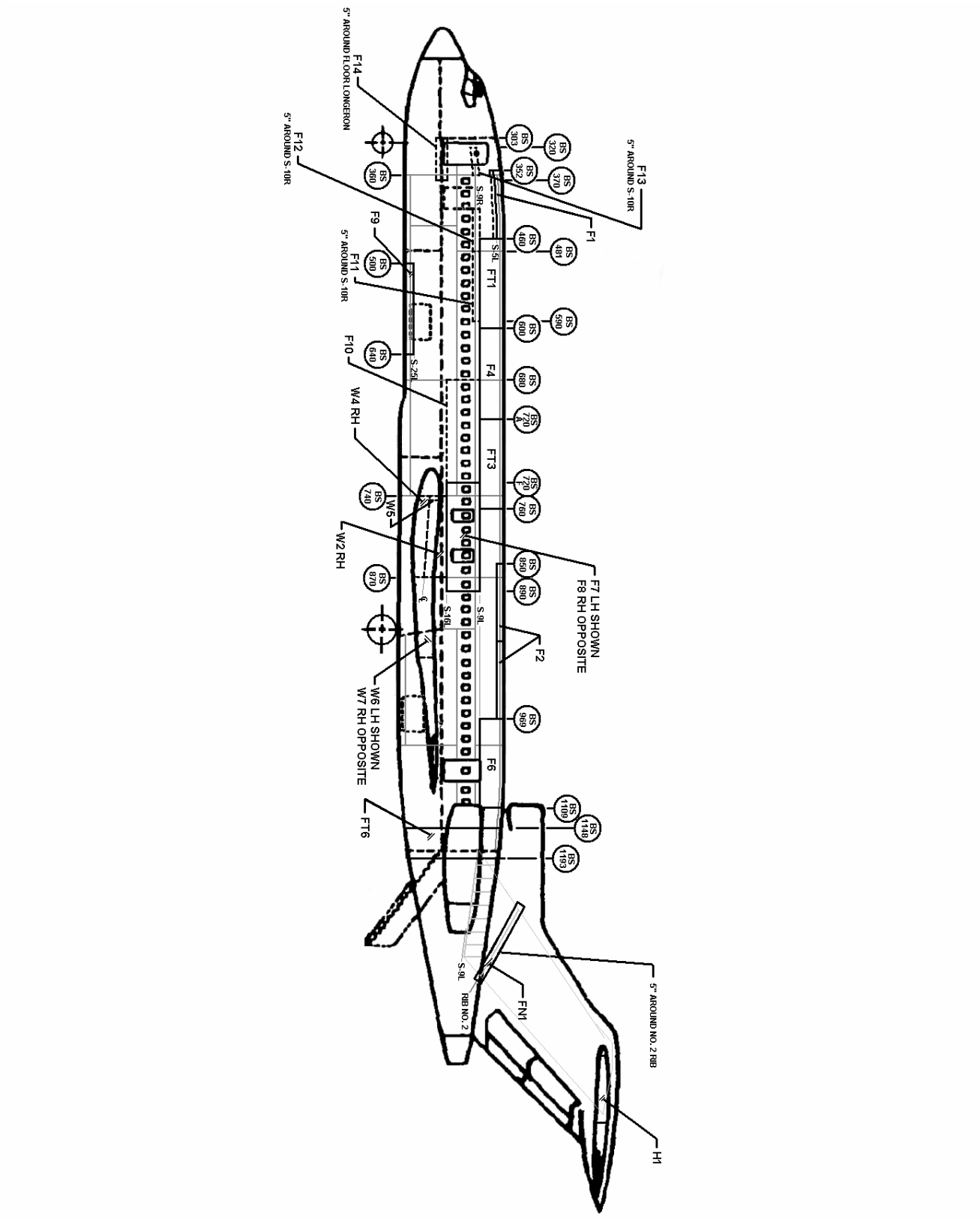

Figure 1. B727-232 Target Areas (Sheet 1 of 2)

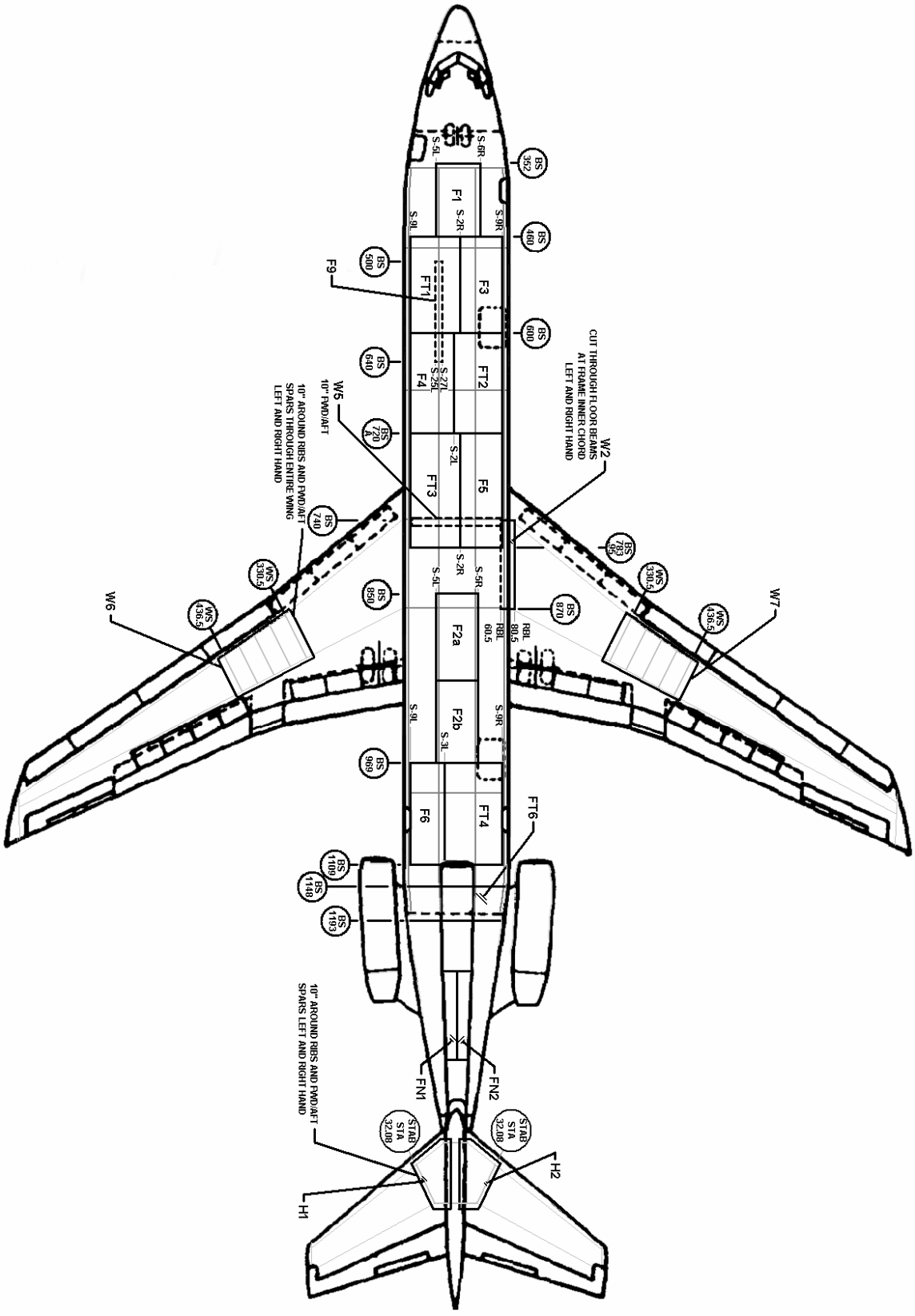

Figure 1. B727-232 Target Areas (Sheet 2 of 2)

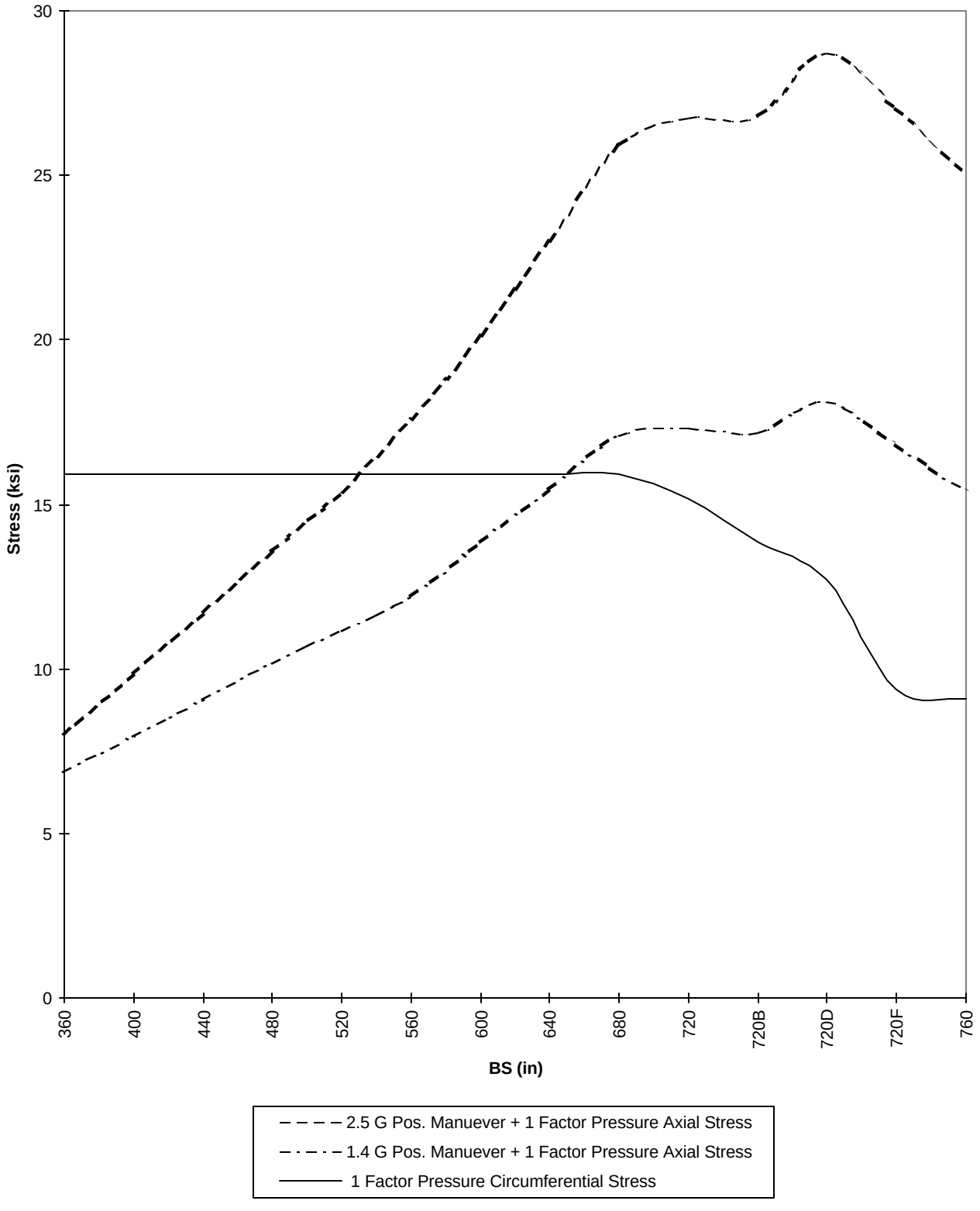

Figure 2. B727 Crown Skin Circumferential and Longitudinal Stresses (Sheet 1 of 2)

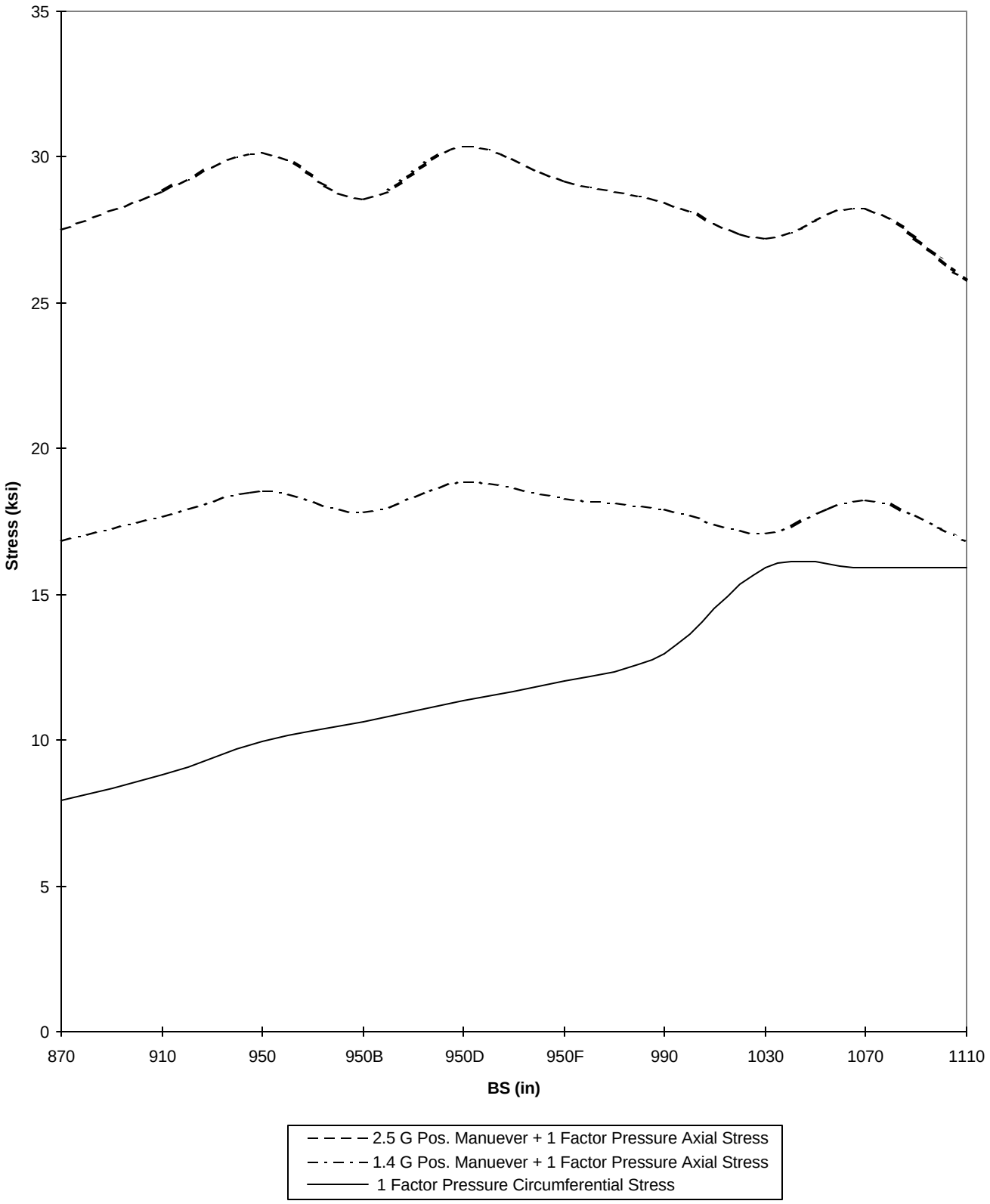

Figure 2. B727 Crown Skin Circumferential and Longitudinal Stresses (Sheet 2 of 2)

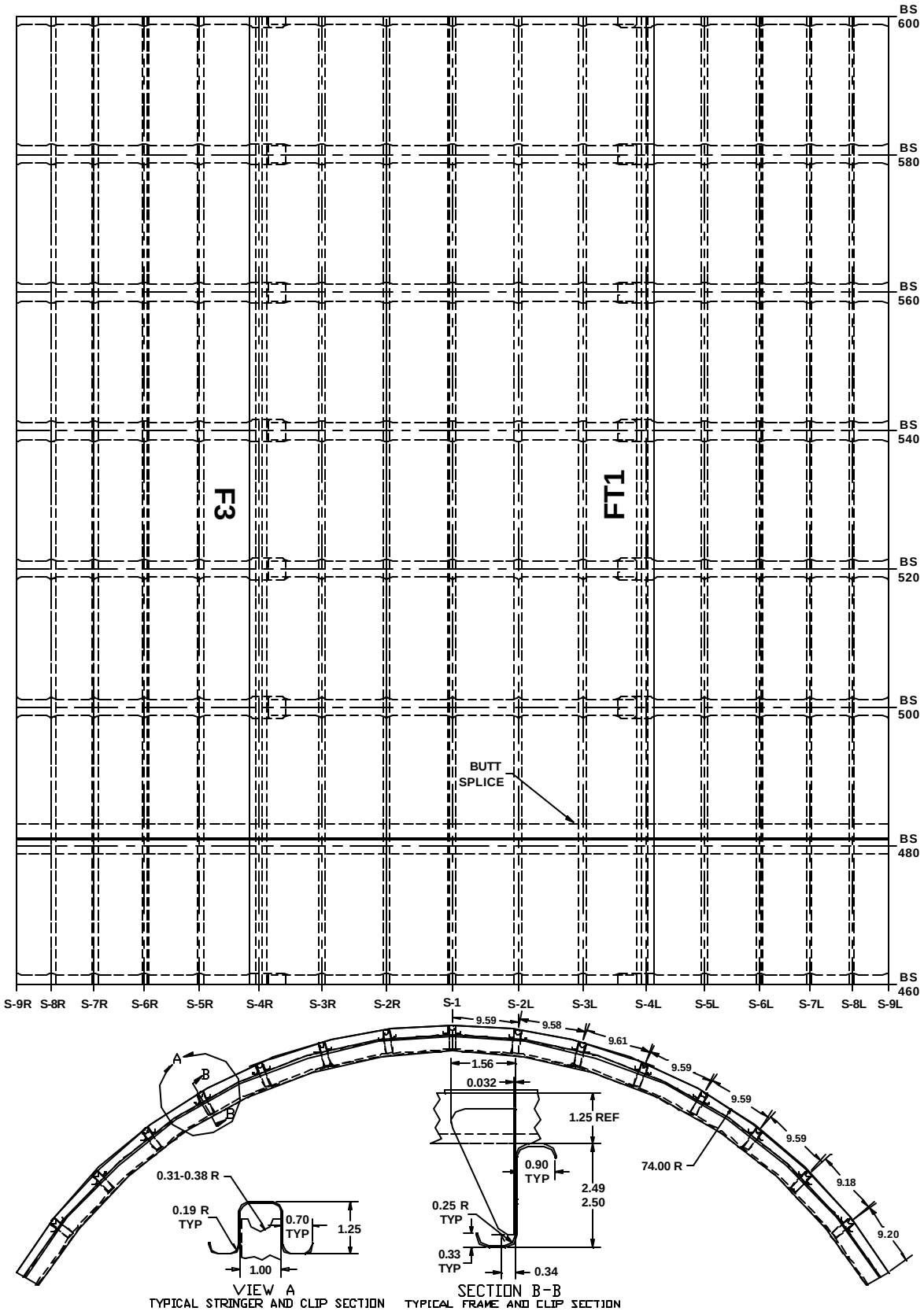

Figure 3. B727 FT1 and F3 Target Areas

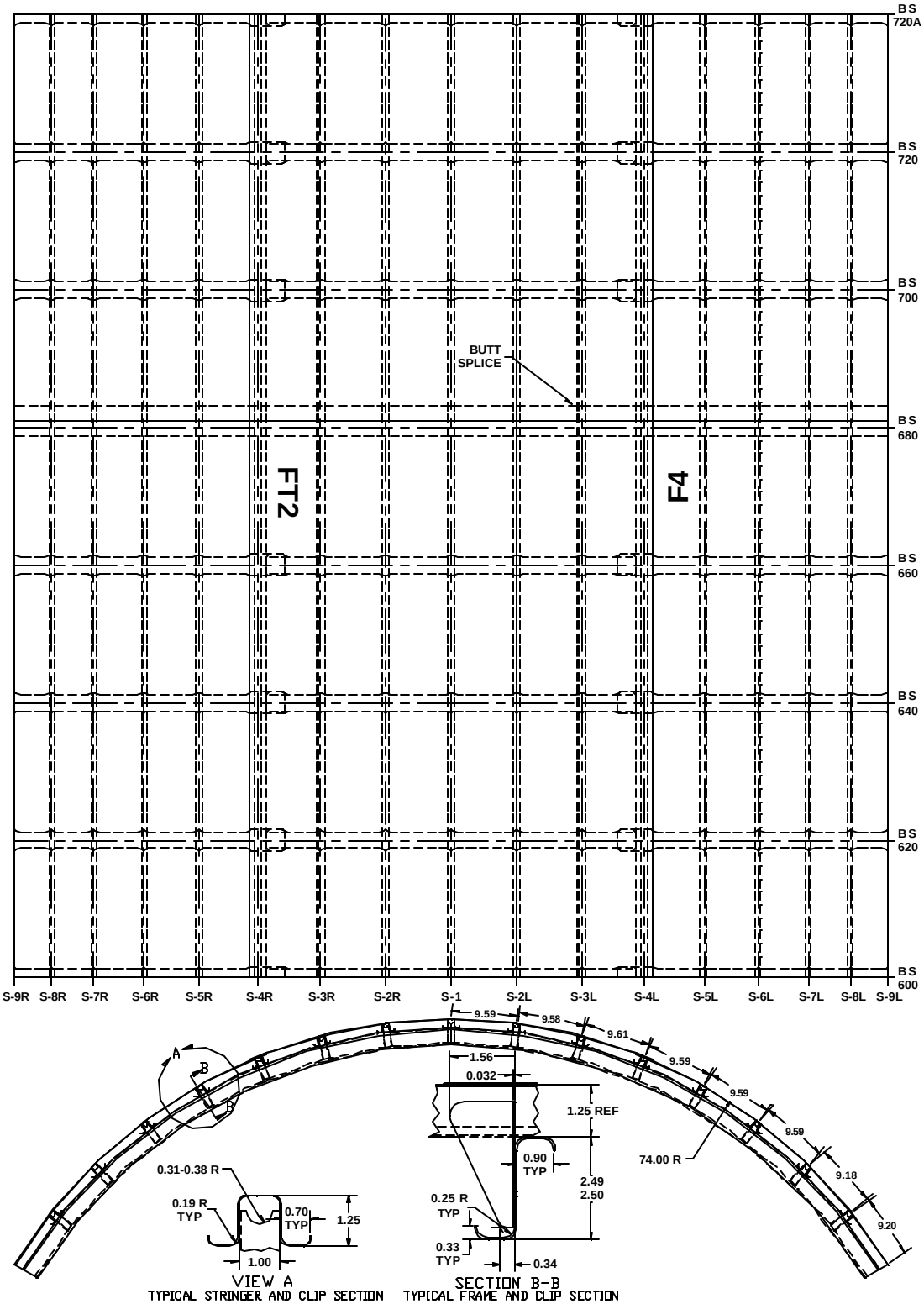

Figure 4. B727 FT2 and F4 Target Areas

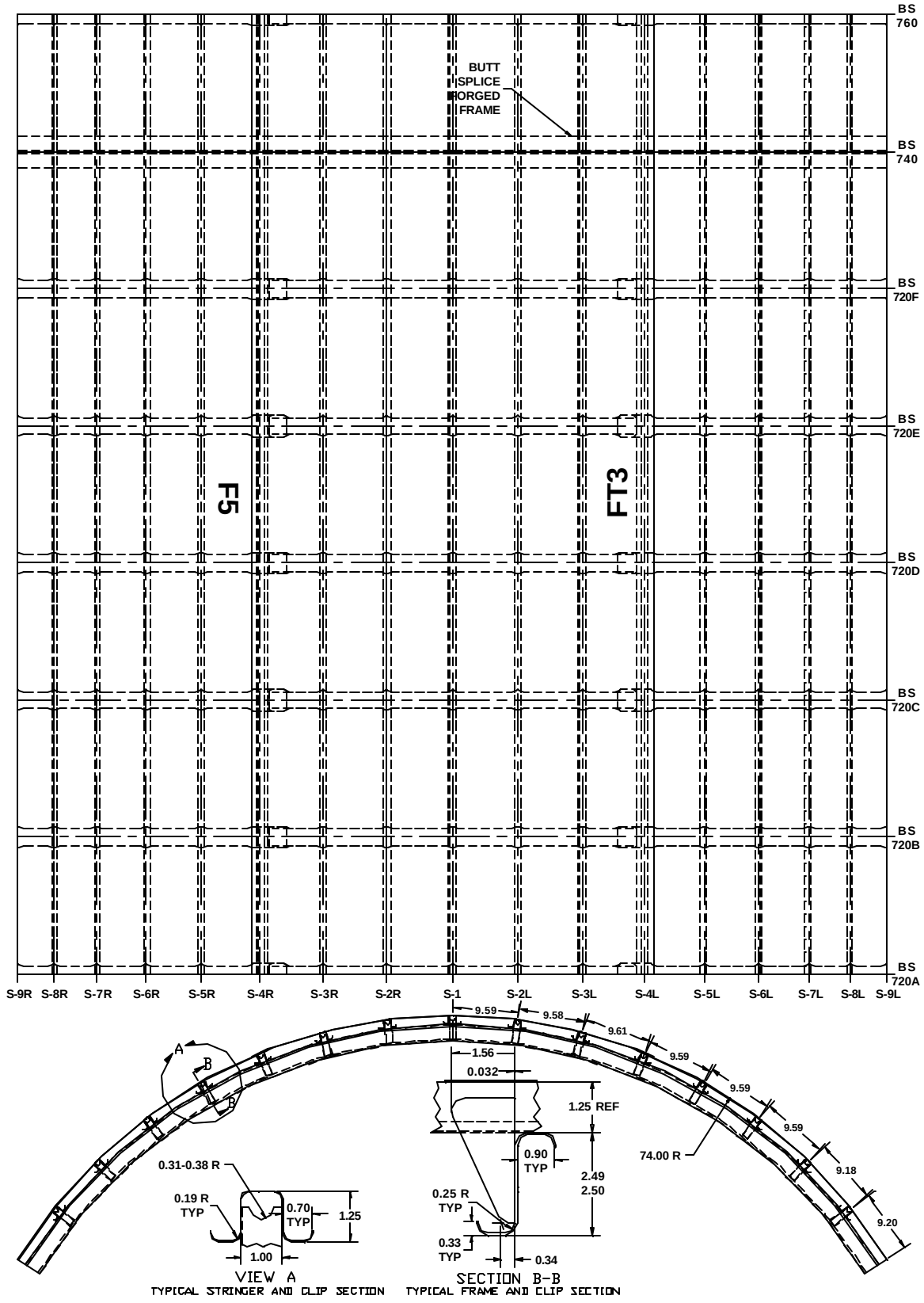

Figure 5. B727 FT3 and F5 Target Areas

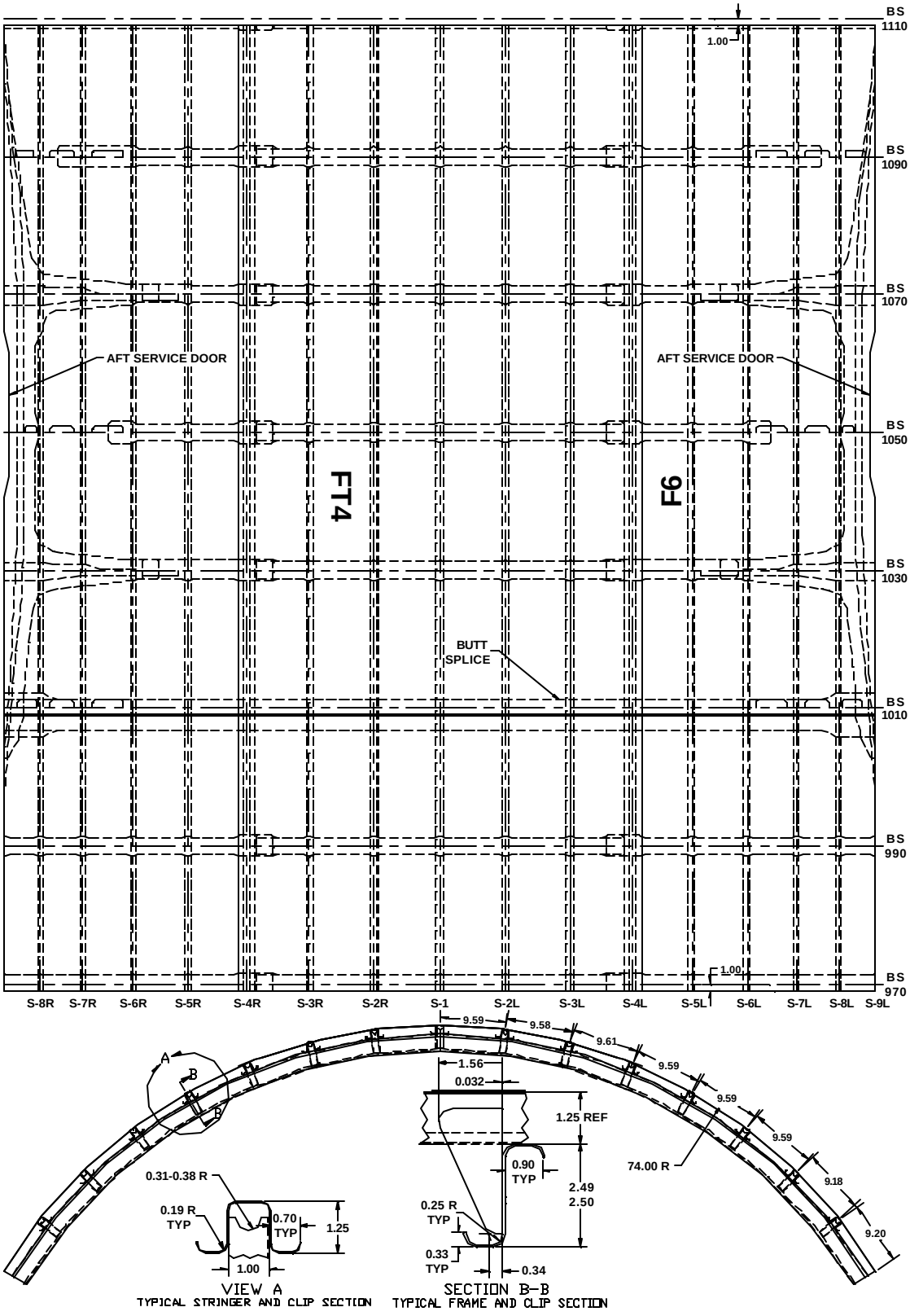

Figure 6. B727 FT4 and F6 Target Areas

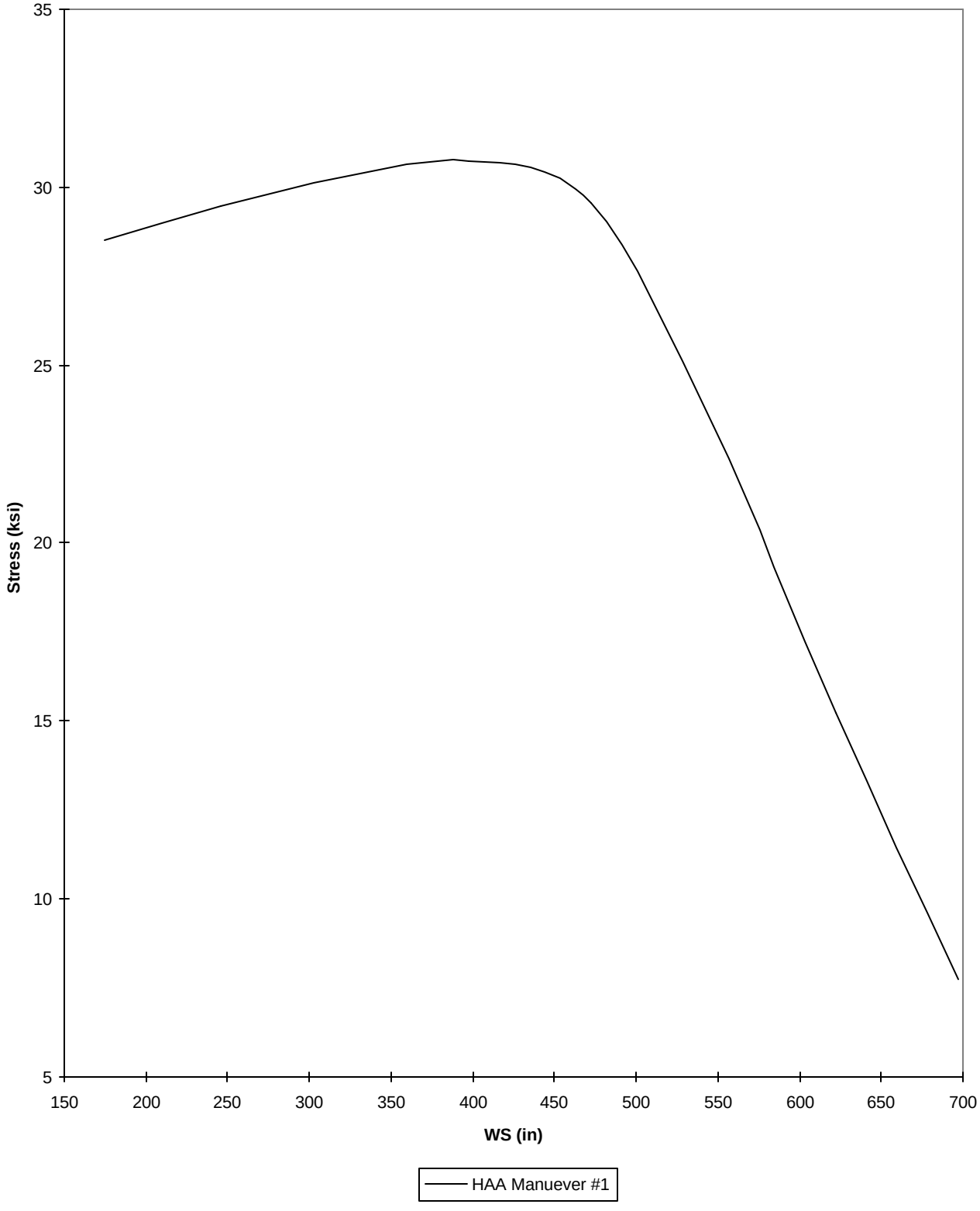

Figure 7. B727 Wing Lower Skin Limit Axial Tension Stress for a High Angle of Attack Maneuver

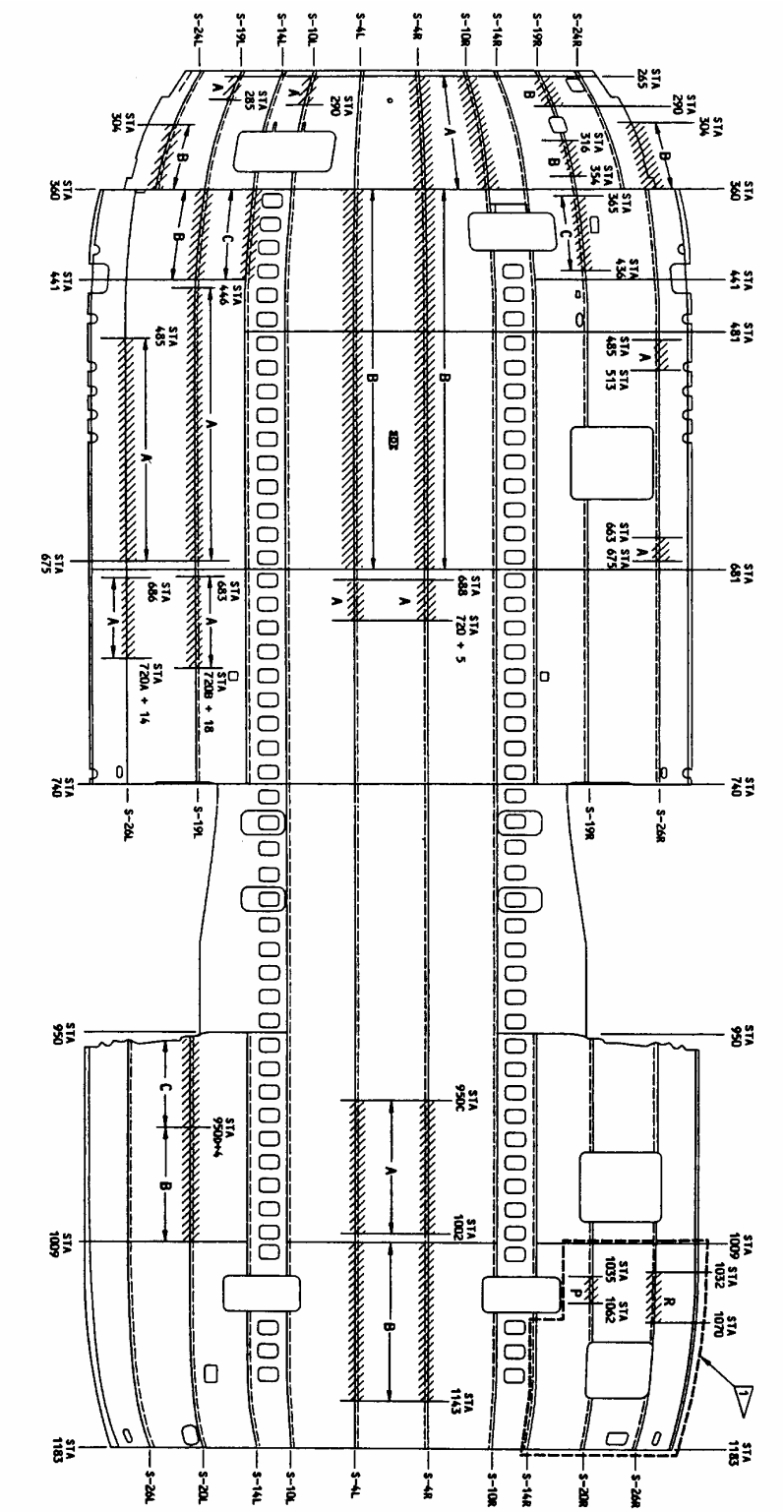

Figure 8. B727 Structurally Significant Item (D6-48040-1, Rev. H) Lap Joint Inspection Area
(Required Inspection areas are shaded)

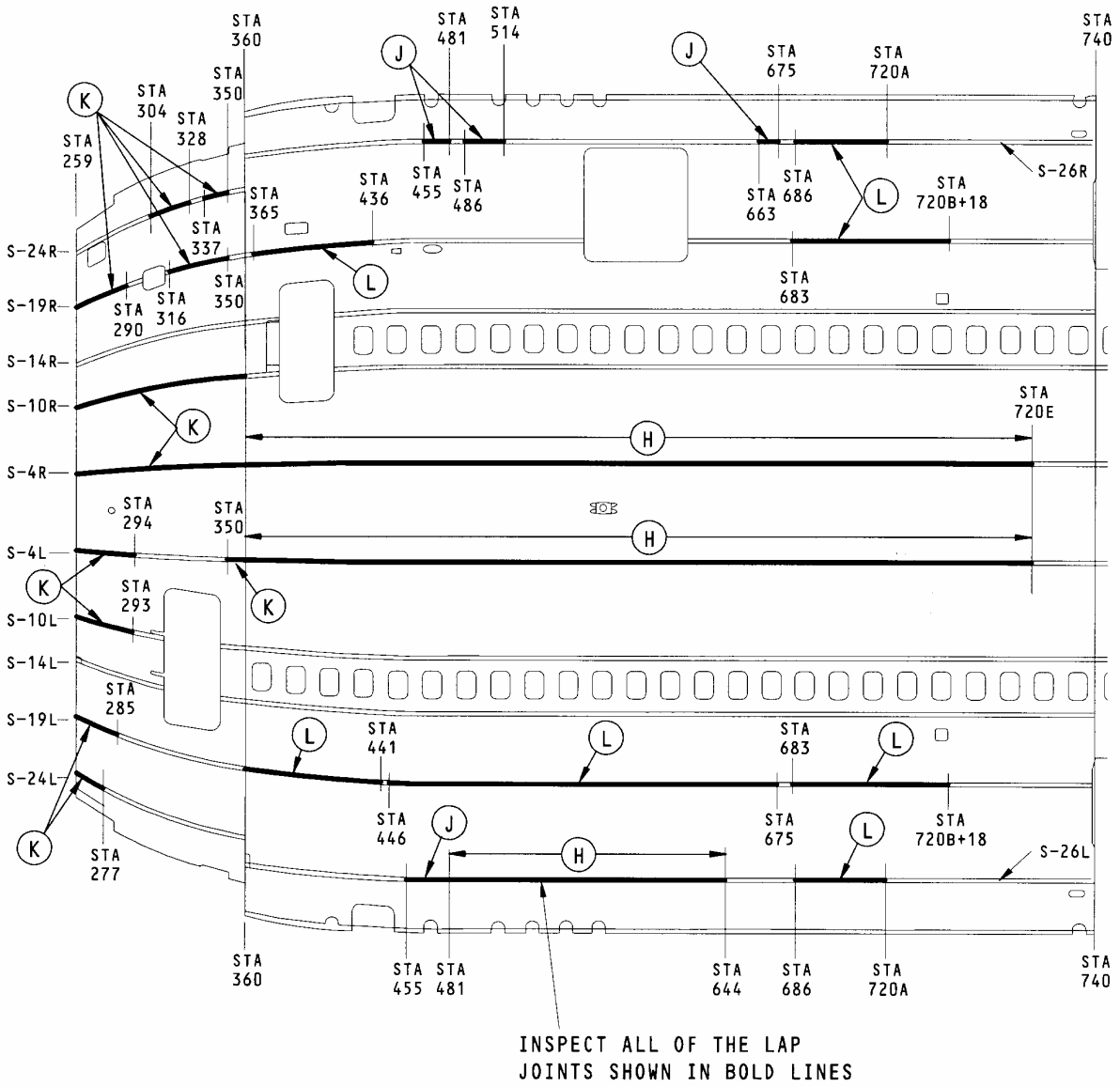

Figure 9. B727 Service Bulletin 727-53-0222 Lap Joint Inspection Area (Sheet 1 of 2)

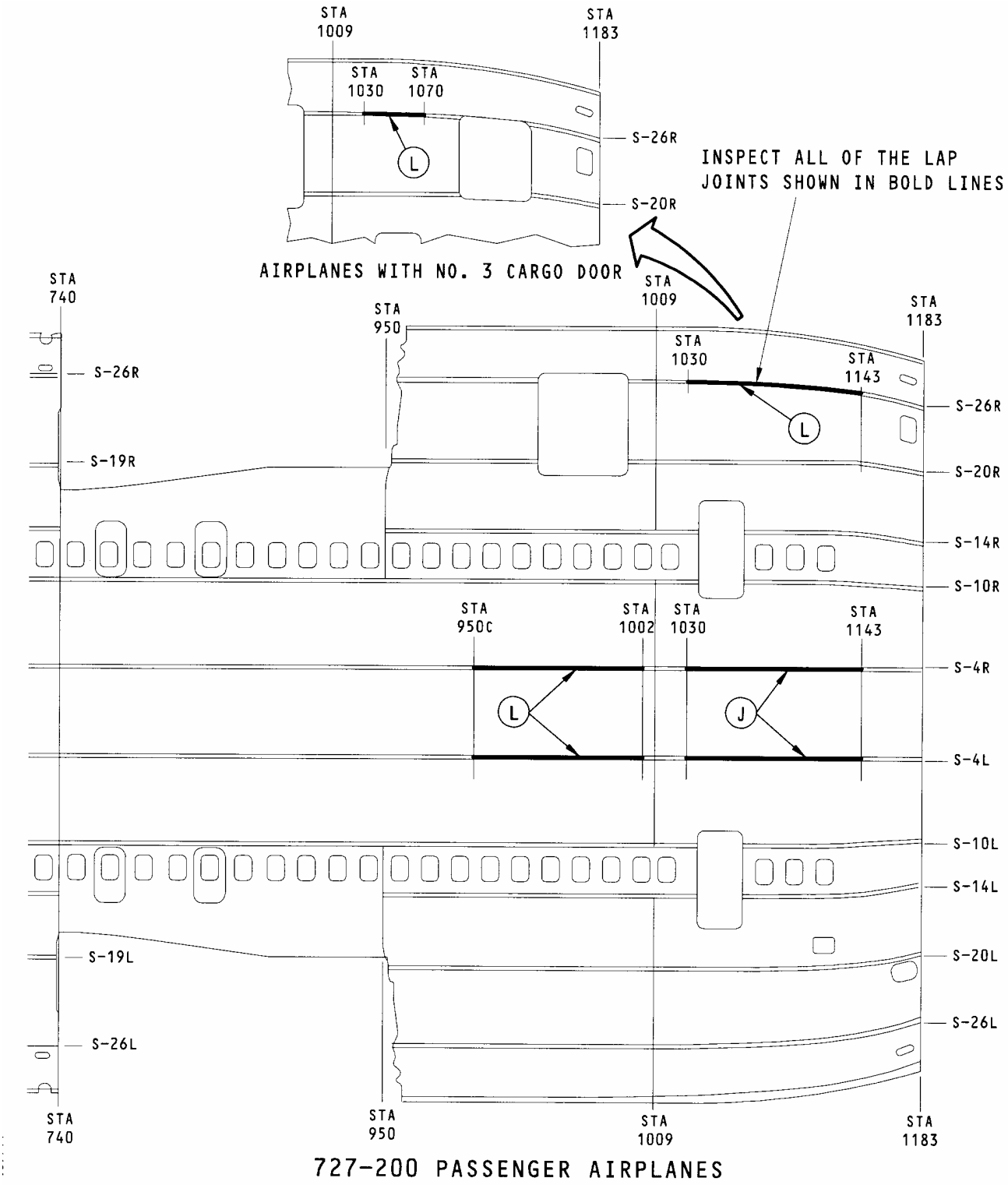

Figure 10. B727 Service Bulletin 727-53-0222 Lap Joint Inspection Area (Sheet 2 of 2)